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USER'S GUIDE
UG-2065-SHR

SHOCK USER'S MANUAL VERSIONN 1.0

by

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14. ABSTRACT

SHOCK is a blast load analysis program, which will calculate the impulse and pressure on all or part of a blast surface, which is bounded by 1 to 4 reflecting surfaces.

SHOCK will read input from a program data file or a Blast Library Database. The input can also be entered interactively. The required input is the length and width of the blast surface, the number and location of the reflecting surfaces and the weight and location of the charge.

SHOCK calculates the impulse and pressure on either all or part of the blast surface from the incident blast wave and from the waves reflecting off of each adjacent surface. SHOCK uses these results to calculate the maximum average pressure on the blast surface from each incident and reflected wave, and the total average impulse from the sum of all the waves. SHOCK also calculates the impulse duration on the blast surface.

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EXECUTIVE SUMMARY

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SHOCK will read input from a program data file or a Blast Library Database. The input can also be entered interactively. The required input is the length and width of the blast surface, the number and location of the reflecting surfaces and the weight and location of the charge.

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1.0 INTRODUCTION

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2.0 PROGRAM DESCRIPTION

2.1 Theory

The initial version of SHOCK is PAIMPRES, developed by Ammonn and Whitney Consulting Engineers to generate the design curves in section 2-14.2 of Reference 1.

SHOCK develops a grid of approximately 1089 points on the blast surface. Shock impulse and pressure is calculated for each grid point on the blast surface for the incident blast wave, and for the shock reflecting off each adjacent surface. The grid point values are averaged and used to calculate the output results.

2.2 Features

SHOCK has the ability to calculate the impulses and pressures on a portion of the blast surface such as a window or doorway. The reduced surface can be either an area or a point. The input coordinates for either the point or the corners of the area will be compared with the coordinates of the blast surface grid. The grid points closest to the specified coordinates will be used to define the reduced surface.

The SHOCK output includes a printout of the total (incident + reflected) impulse at points on the blast surface grid. The grid printout can be compressed or full or omitted. In full grid printout, the impulse at each grid point is printed. In compressed printout, the impulse is printed at a limited number of equally spaced grid points. The spacing is chosen such that only nine columns of impulse values will be printed, and the output for grid values and analysis results will be limited to one page.

Whether or not the full grid is requested, it will be printed if it can fit on the same page as the analysis results. If the full grid is printed, it will be identified as such even if a compressed grid was specified.

The choice of grid printout only affects the output. It has no effect on the analysis results.

2.3 Limitations

The names of the input data file and the database file are limited to 12 characters.

3.0 PROGRAM OPERATION

3.1 Program Execution

SHOCK is written in FORTRAN and can be executed through keyboard input on computers ranging from personal computers to main-frames. After the program is initiated, the following will be displayed:

PROGRAM SHOCK
VERSION 1.0

ENTER SOURCE OF INPUT DATA, OR "X" TO EXIT PROGRAM

A. INTERACTIVE ENTRY
B. DATABASE FILE
C. SHOCK DATA FILE

Typing A, B or C, and then the RETURN or ENTER key will cause execution to resume.

3.2 Program Input

The input parameters for SHOCK are shown in Figure 1 and Figure 2, and are described below.

VARIABLE	DESCRIPTION AND UNITS
W	Charge weight, lbs
RA	Normal distance from charge to blast surface, ft
RL	Width of blast surface, ft
H	Height of blast surface, ft
SL	Normal distance from charge to reflecting surface 2, ft
SH	Normal distance from charge to reflecting surface 1, ft
X1	Normal distance from reflecting surface 2 to the upper left corner of the reduced surface, or the normal distance from reflecting surface 2 to the reduced surface point, ft
Y1	Normal distance from reflecting surface 1 to the upper left corner of the reduced surface, or the normal distance from reflecting surface 1 to the reduced surface point, ft
X2	Normal distance from reflecting surface 2 to the lower right corner of the reduced surface, ft
Y2	Normal distance from reflecting surface I to the lower right corner of the reduced surface, ft

In addition to these parameters, the input includes variables to indicate which of the reflecting surfaces exist, and to indicate the extent of printout for the impulse grid.

In the program input and output, the use of "vertical" and "horizontal" to describe certain

variables, as well as the description of the various reflecting surfaces as walls, ceilings, or floors, are aids to help the user visualize the relationship of the variables. The descriptions assume that the reflecting surface is a wall. If SHOCK is used to calculate the loads on a surface other than a wall, the interrelationship of the reflecting surfaces and the variables RL, H, SL, SH, and RA will remain the same as shown in Figure 1.

3.2.1 Interactive Input. If interactive input is chosen, the next prompts will be for the run title, the output file name, and the extent of output for the impulse grid. SHOCK will then display the following menu:

SELECT LETTER TO INPUT/MODIFY PARAMETERS

A.	CHARGE WEIGHT, LBS	0.00
B.	DISTANCE TO BLAST SURFACE, FT	0.00
C.	HEIGHT OF BLAST SURFACE, FT	0.00
D.	WIDTH OF BLAST SURFACE, FT	0.00
E.	VERTICAL (Y) DISTANCE TO CHARGE FROM REFLECTING SURFACE NQ. 1, FT.....	0.00
F.	HORIZONTAL (X) DISTANCE TO CHARGE FROM REFLECTING SURFACE NO. 2, FT.....	0.00
G.	REFLECTING SURFACES	
	"1" IF SURFACE EXISTS, "0" IF IT DOESN'T	
	SURFACE 1 (FLOOR)	0
	SURFACE 2 (LEFT SIDEWALL)	0
	SURFACE 3 (CEILING)	0
	SURFACE 4 (RIGHT SIDEWALL)	0
H.	REDUCED SURFACE CALCULATION	NO
I.	WRITE PARAMETERS TO EXISTING DATABASE	
J.	NO CHANGES	

The values for each input parameter can be changed by typing the corresponding letter on the menu and entering the new parameter value. The changes will be made and the menu will be redisplayed after each change until 'J' is typed.

Choice 'I' can be used to write the parameter values to an existing Blast Library database.

If 'H' is typed, the following prompt will be displayed

ENTER "A" FOR AN AREA, "P" FOR A POINT, OR "N" TO CANCEL

If 'A' is chosen, SHOCK will display prompts for the coordinates of the upper left and lower right corners of the surface. If 'P' is chosen, shock will display a prompt for the coordinates of the point.

Typing 'J' in response to the menu will halt the input and start the problem solution. Once the solution is complete, the following prompt will be displayed:

TYPE "Y" TO RUN ANOTHER PROBLEM OR
TYPE ANY OTHER KEY TO EXIT PROGRAM

If ‘Y’ is typed, the input menu will be displayed with the parameters from the problem which was just completed. If any other key is typed, the program will close all files and stop.

3.2.2 Database Input. Database input requires an existing Blast Design Software Library Database file. The database file is designed to minimize user input to the programs in the Blast Design Software Library. This file can be accessed by all programs in the library to read from and write to, key parameters that were generated or will be required by other library programs. Any data that is lacking for a particular computer run can then be supplied by the user. The required format for this file is given in the Blast Design Software Library Database Manual.

If database input is chosen, SHOCK will display prompts for the name of the database file, the title of the run, the name of the output file, and the extent of the output grid. The database parameter values will then be read and displayed in the same menu that was displayed for interactive input. Any required changes can be made to the parameters in this menu.

The Blast Library database does not store reduced surface parameters. Therefore, if a reduced surface is required, it will have to be entered interactively.

Once any required changes have been made, the problem solution can be started by selecting ‘J’ in the menu. After the solution has been completed, the following prompt will appear:

TYPE “Y” TO RUN ANOTHER PROBLEM OR
TYPE ANY OTHER KEY TO EXIT PROGRAM

If ‘Y’ is typed, SHOCK will display a prompts for another database input problem. If any other key is typed, the program will close all files and stop.

3.2.3 SHOCK Data File Input. The SHOCK data file will consist of 3 or 4 types of data cards. The title card, data card, and termination card must be included. The reduced surface card is only required if ‘A’ or ‘P’ is entered in column 75 of the data card. The card formats are shown below.

Card 1: Title Card (1I5, 75A1)

COLUMN	VARIABLE	DESCRIPTION
4-5	ICN	the numerals ‘01’
6-80	TITLE	problem title

Card 2: Data Card (1I5, 6F10.0, 4I1, 3X, 1Al, lx, 1A1)

COLUMN	VARIABLE	DESCRIPTION
4-5	ICN	the numerals ‘02’
6-15	W	charge weight
16-25	RA	horizontal distance to charge from blast surface
26-35	RL	length of blast surface
36-45	H	height of blast surface

46-55	SL	horizontal distance to charge from reflecting surface 2
56-65	SH	vertical distance to charge from reflecting surface 1
66	NR(l)	existence code for reflecting surface 1 '1' if the surface exists, '0' if it doesn't
67	NR (2)	existence code for reflecting surface 2
68	NR (3)	existence code for reflecting surface 3
69	NR (4)	existence code for reflecting surface 4
73	GRID	impulse grid printout code 'F' print full impulse grid 'C' print compressed impulse grid suppress impulse grid (default)
75	REDRSF	reduced surface code 'A' if the reduced surface is an area 'P' if the reduced surface is a point if the whole load wall is to be considered (default)

Card 3: Reduced Surface Card (1I5, 4F10.0)

Required only if REDSRF .eq. 'A' or 'P'

COLUMN	VARIABLE	DESCRIPTION
4-5	ICN	the numerals '03'
6-15	Xl	the X-coordinate of the upper left corner of the reduced surface area , or the X-coordinate of the reduced surface point
16-25	Y1	the Y-coordinate of the upper left corner of the reduced surface area, or the Y-coordinate of the reduced surface point
26-35	X2	the X coordinate of the lower right corner of reduced surface area
36-45	Y2	the Y coordinate of the lower right corner of reduced surface area

Card 4: Termination Card (1I5)

COLUMN	VARIABLE	DESCRIPTION
4-5	ICN	the numerals '99'

One set of type 1, 2, and 3 (if required) cards should be included in the input deck for each problem. The last card in the deck should be a type 4 card. The arrangement of the deck is shown below:

COLUMNS 12345	CARD DESCRIPTION	
01	Card 1:	Title card
02	Card 2:	Data card
03	Card 3:	Reduced surface card - only if column 75 of the previous card is not blank
01 02 03	Include a set of type 1, 2, and 3 cards for each additional problems	
99	Card D: Termination card	

3.3 Output

The program output is independent of the method of data input. If a compressed output impulse grid is specified in the input, or if the full grid is small enough, the output will consist of two pages.

The program identification and a table listing of the input data will be printed on the first page. The impulse grid and analysis results will be printed on the second page.

If a full grid is specified, it will be printed on as many pages as are required, and the analysis results will be printed on the final page.

The analysis results include the average pressure and impulse on the blast surface due to the incident wave and the reflected wave off each existing adjacent surface. The final pressure result is the maximum of the average pressures on the blast surface from the incident wave or any of the reflected waves. The final impulse result is the sum of the average impulses on the blast surface from the incident wave and all reflected waves. The results conclude with the impulse duration on the blast surface.

The output for three example problems is included in Section 5.

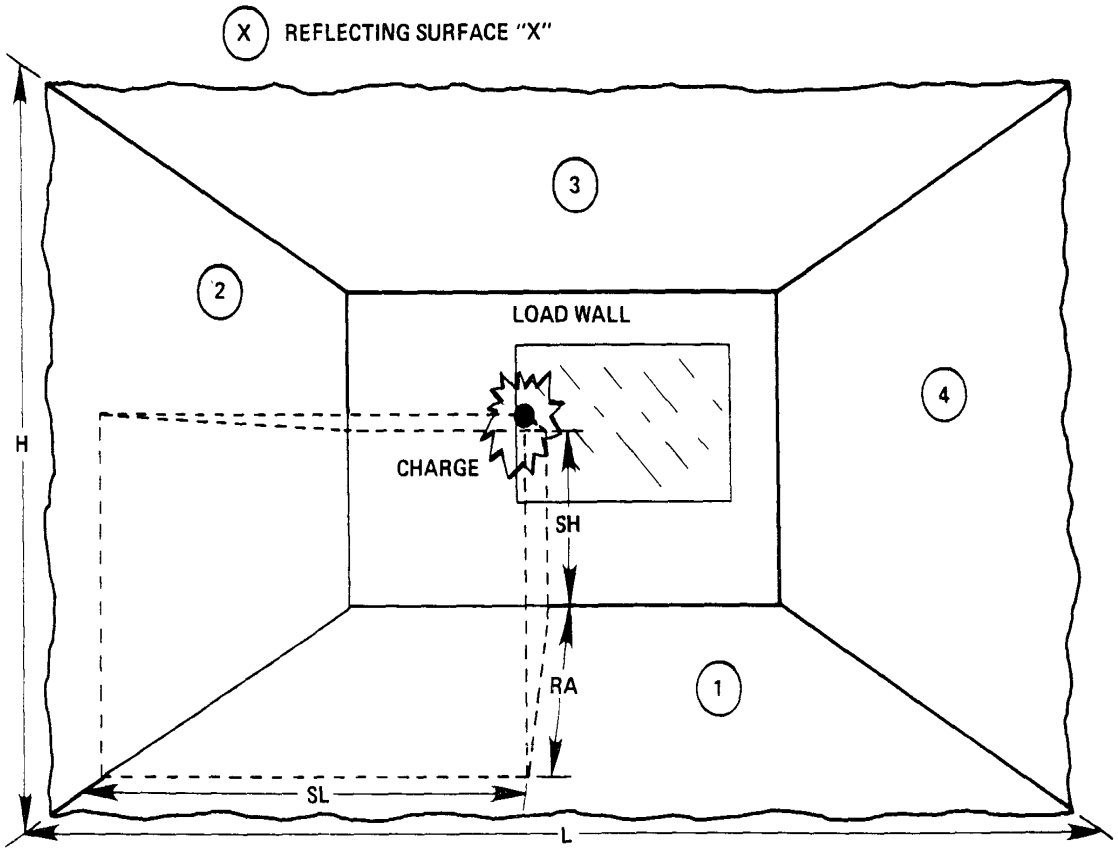

Figure 1.

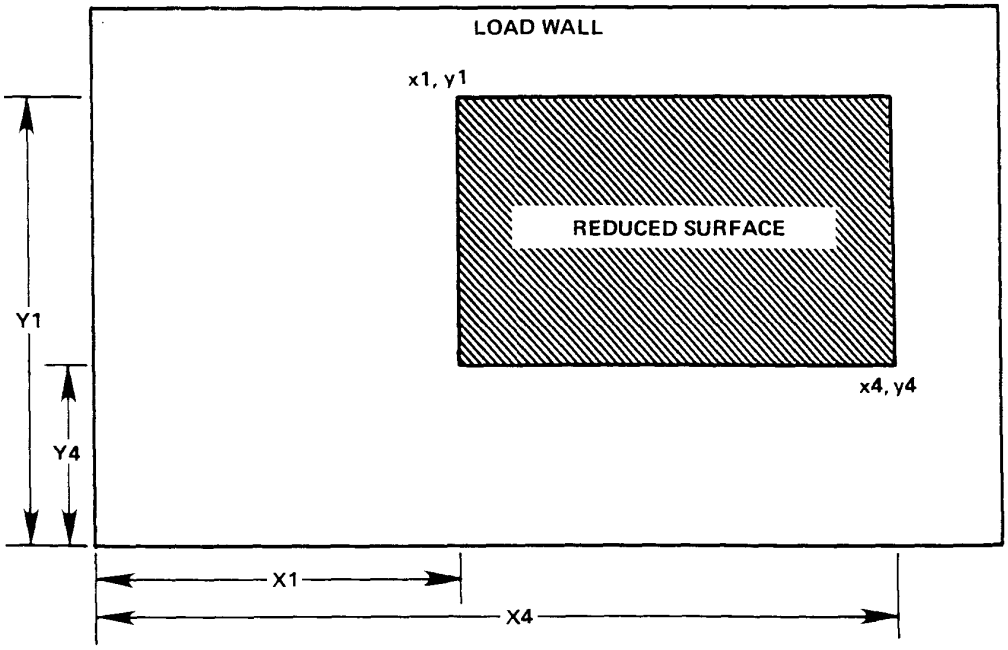

Figure 2.

4.0 REFERENCES

1. U.S. Army Armament Research, Development and Engineering Center. Structures to Resist the Effects of Accidental Explosions, Volume II: Blast, Fragment, and Shock Loads. Special Publication ARLCD-SP-84001. Dec 1986.

5.0 SAMPLE PROBLEMS

The output for three sample problems is include in this section. The first problem has no reduced surface and a full impulse grid printout. The second problem has an area reduced surface and a compressed impulse grid printout. The third problem has a point reduced surface and a full grid printout. The input for the example problems was read from a shock data file, but the output would be identical for any other input method.

Input Deck

```
01  EXAMPLE PROBLEM    1   -   ENTIRE  SURFACE,    FULL GRID PRINTOUT
02  100.          5.              20.         16.         5.          5.          1  11      F
01  EXAMPLE  PROBLEM    2   -   AREA REDUCED SURFACE, COMPRESSED  GRID  OUTPUT
02  100.          5.              16.         10.         5.          5.          1111    C   A
03  4.          12.               12.          4.
01  EXAMPLE  PROBLEM    3   -   POINT REDUCED SURFACE, FULL GRID OUTPUT
02  100.          5.              16.         16.         5.          5.          1       F   P
03  6.          10.               10.          6.
99
```

PROGRAM SHOCK
VERSION 1.0

****

PROGRAM FOR CALCULATION OF AVERAGE BARRIER REFLECTED SHOCK PRESSURES AND IMPULSES DUE TO AN INCIDENT WAVE AND REFLECTED WAVES FROM ONE TO FOUR REFLECTION SURFACES.
ORIGINAL PROGRAM "PAIMPRES" DEVELOPED BY AMMANN AND WHITNEY
MODIFIED TO "SHOCK" BY NAVAL CIVIL ENGINEERING LAB

INPUT DATA

DATA SET TITLE:
EXAMPLE PROBLEM 1 - ENTIRE SURFACE, FULL GRID PRINTOUT

A. CHARGE WEIGHT, LBS	100.00
B. DISTANCE TO BLAST SURFACE, FT	5.00
C. WIDTH OF BLAST SURFACE FT	20.00
D. HEIGHT OF BLAST SURFACE, FT	16.00
E. HORIZONTAL (X) DISTANCE TO CHARGE FROM REFLECTING SURFACE NO. 2, FT	5.00
F. VERTICAL (Y) DISTANCE TO CHARGE FROM REFLECTING SURFACE NO. 1, FT	5.00
G. REFLECTING SURFACES "1" FOR FULL REFLECTION, "0" FOR NONE	
SURFACE 1 (FLOOR)	1
SURFACE 2 (LEFT SIDEUALL)	0
SURFACE 3 (CEILING)	1
SURFACE 4 (RIGHT SIDEWALL)	1
H. REDUCED SURFACE CALCULATION	NO

IMPULSE GRID

NUMBER OF VERTICAL GRID LINES ON BLAST SURFACE 33
NUMBER OF HORIZONTAL GRID LINES ON BLAST SURFACE 33

DISTANCE BETWEEN VERTICAL GRID LINES= 0.62 FT
DISTANCE BETWEEN HORIZONTAL GRID LINES = 0.50 FT

FULL IMPULSE GRID IN PSI-MS/LBS**1/3

Y GRID	X GRID COORDINATES								
COORDS	0.00	0.62	1.25	1.87	2.50	3.12	3.75	4.37	5.00
16.00	20.9	42.2	42.8	43.3	43.6	43.9	44.1	44.3	43.5
15.50	42.1	85.0	85.7	86.6	87.4	88.1	88.6	89.0	87.5
15.00	42.4	85.9	86.8	87.6	88.2	88.8	89.3	89.6	88.2
14.50	42.9	87.0	88.0	88.9	89.7	90.3	90.9	91.3	89.9
14.00	43.5	88.2	89.4	90.4	91.3	92.1	92.7	93.2	91.8
13.50	44.1	89.6	91.0	92.2	93.2	94.1	94.7	95.2	93.8
13.00	44.8	91.2	92.7	94.1	95.2	96.2	97.0	97.6	95.8
12.50	45.6	93.3	94.9	96.4	97.9	99.1	100.1	100.9	98.7
12.00	46.7	95.4	97.4	99.3	101.2	102.8	104.1	105.0	102.4
11.50	47.7	97.9	100.4	102.9	105.2	107.2	108.8	109.9	107.0
11.00	48.9	100.9	104.0	107.0	109.9	112.4	114.4	115.8	112.4
10.50	50.3	104.3	108.1	111.9	115.4	118.4	120.9	122.5	118.9
10.00	52.0	108.1	112.5	117.0	121.3	125.7	129.5	132.0	128.5
9.50	53.7	112.3	117.5	122.9	129.4	135.2	140.0	143.2	139.7
9.00	55.5	116.8	123.0	1312	139.0	146.3	152.2	156.1	152.5
8.50	57.4	121.6	130.4	140.0	149.6	158.4	165.6	170.5	166.8
8.00	59.4	127.2	138.0	149.4	160.8	171.4	180.4	186.5	182.7
7.50	61.3	133.3	145.7	158.8	172.2	185.1	195.7	202.2	198.0
7.00	63.4	139.2	153.0	167.8	183.9	198.9	210.6	219.0	213.3
6.50	65.5	144.6	160.6	177.6	195.2	210.4	224.0	235.0	230.7
6.00	67.8	150.2	166.1	183.9	202.5	219.5	236.5	249.4	246.8
5.50	69.2	153.0	169.7	188.7	207.9	226.5	245.7	260.4	257.3
5.00	69.9	154.7	171.9	191.4	211.0	230.3	250.5	265.1	264.3
4.50	70.2	155.5	172.7	192.1	211.8	230.9	250.8	265.9	261.3
4.00	70.2	155.3	172.3	191.8	212.0	230.5	248.5	262.1	254.7
3.50	70.0	155.1	172.6	191.5	211.5	229.4	245.3	257.5	242.6
3.00	70.2	155.7	173.0	192.2	212.4	231.9	247.1	257.8	229.0
2.50	70.9	157.5	176.2	197.3	218.5	238.7	255.8	267.2	217.2
2.00	72.8	162.9	184.4	207.4	233.3	257.1	276.5	289.5	206.2
1.50	76.5	173.0	199.2	229.5	259.4	287.8	311.9	324.8	195.2
1.00	82.0	191.5	224.0	261.4	297.4	330.2	360.5	384.3	186.6
0.50	91.0	217.8	262.2	301.8	356.2	433.9	489.8	527.4	180.4
0.00	61.5	158.3	202.0	266.3	361.5	456.8	544.4	608.2	89.4

Y GRID	X GRID COORDINATES								
COORDS	5.62	6.25	6.87	7.50	8.12	8.75	9.37	10.00	10.62
16.00	44.6	44.6	44.7	44.7	44.5	44.3	44.1	43.8	43.9
15.50	89.5	89.6	89.6	89.4	89.1	88.8	88.6	88.3	88.0
15.00	90.1	90.3	90.3	90.3	90.1	89.8	89.4	89.1	88.7
14.50	91.8	91.9	91.8	91.7	91.4	91.0	90.5	90.0	89.5
14.00	93.6	93.7	93.6	93.3	92.9	92.3	91.7	91.1	90.4
13.50	95.6	95.7	95.5	95.1	94.6	93.9	93.1	92.3	91.4
13.00	98.1	97.9	97.6	97.1	96.5	95.6	94.6	93.7	92.6
12.50	101.3	101.1	100.5	99.8	98.8	97.7	96.7	95.3	93.9
12.00	105.4	105.0	104.2	103.0	101.7	100.2	98.8	97.5	95.8
11.50	110.4	109.7	108.6	107.0	105.2	103.2	101.3	99.5	97.8
11.00	116.3	115.3	113.8	111.7	109.3	106.8	104.3	101.9	99.7
10.50	123.0	121.8	119.8	117.1	114.1	110.9	107.7	104.7	101.8
10.00	132.4	130.3	127.0	123.0	119.2	115.3	111.5	107.9	104.5
9.50	143.6	140.9	136.5	131.1	125.0	120.2	115.6	111.3	107.4
9.00	156.5	153.1	147.6	140.8	133.2	125.7	120.1	114.9	110.3
8.50	170.9	166.5	159.7	151.3	142.1	133.1	124.8	118.7	113.2
8.00	186.9	181.2	172.7	162.4	151.5	140.7	130.5	122.6	116.3
7.50	202.6	196.5	186.3	173.8	160.9	148.3	136.6	126.5	119.3
7.00	219.4	211.5	200.2	185.5	169.9	155.6	142.4	130.7	122.3
6.50	235.4	224.9	211.6	196.9	179.7	163.2	147.8	134.8	125.0
6.00	249.8	237.3	220.7	204.1	186.0	168.8	153.4	139.3	127.5
5.50	260.8	246.5	227.7	209.5	190.7	172.3	156.2	142.1	130.9
5.00	265.5	251.3	231.5	212.6	193.5	174.6	157.9	143.4	131.8
4.50	266.3	251.6	232.2	213.4	194.2	175.3	158.7	144.1	132.4
4.00	262.5	249.3	231.7	213.6	193.9	175.0	158.5	144.1	132.8
3.50	258.0	246.1	230.6	213.1	193.6	175.2	158.3	143.7	133.0
3.00	258.2	247.9	233.1	214.0	194.3	175.6	158.9	144.1	133.1
2.50	267.6	256.6	239.9	220.1	199.4	178.9	160.7	145.6	134.6
2.00	289.9	277.3	258.3	234.9	209.5	187.0	166.1	149.4	136.8
1.50	325.2	312.8	289.0	261.1	231.7	201.9	176.3	156.8	140.9
1.00	384.7	361.3	331.4	299.1	263.5	226.7	194.8	168.0	148.1
0.50	527.8	490.6	435.2	358.0	304.0	264.9	221.1	185.9	158.4
0.00	608.5	544.8	457.5	362.4	267.4	203.3	159.9	124.9	97.9

Y GRID	X GRID COORDINATES								
COORDS	11.25	11.87	12.50	13.12	13.75	14.37	15.00	15.62	16.25
16.00	44.0	44.1	44.1	44.0	43.9	43.7	47.3	46.2	45.0
15.50	88.0	88.0	87.9	87.8	87.5	87.1	87.6	87.2	85.1
15.00	88.2	87.9	87.8	87.6	87.3	86.9	88.3	86.4	84.2
14.50	88.9	88.2	87.6	87.4	87.1	86.6	87.7	85.5	83.4
14.00	89.6	88.8	87.9	87.2	86.8	86.4	86.7	84.6	82.7
13.50	90.5	89.5	88.5	87.4	86.6	86.1	85.8	83.9	82.0
13.00	91.4	90.3	89.1	87.8	86.6	85.8	85.0	83.2	81.8
12.50	92.5	91.1	89.7	88.3	86.9	85.6	84.3	82.9	81.7
12.00	93.9	92.1	90.5	88.9	87.3	85.8	84.1	82.8	81.6
11.50	95.7	93.6	91.5	89.5	87.9	86.4	84.2	82.8	81.6
11.00	97.7	95.2	92.9	90.8	88.7	87.0	84.6	82.7	81.5
10.50	99.3	97.1	94.6	92.2	90.0	87.9	85.0	82.7	81.4
10.00	101.6	99.1	96.5	93.8	91.3	89.0	85.8	83.1	81.3
9.50	104.0	101.0	98.3	95.4	92.6	90.1	86.7	83.8	81.3
9.00	106.2	102.9	100.0	97.0	94.0	91.2	87.6	84.6	81.8
8.50	108.5	104.6	101.4	98.6	95.4	92.3	88.6	85.4	82.5
8.00	110.9	106.4	102.7	99.8	96.6	93.5	89.5	86.3	83.2
7.50	113.2	108.1	104.0	100.8	97.5	94.4	90.5	87.1	83.9
7.00	115.5	109.9	105.3	101.7	98.4	95.1	91.3	87.9	84.7
6.50	117.7	111.6	106.6	102.6	99.2	95.8	91.9	88.7	85.4
6.00	119.6	113.1	107.8	103.6	100.0	96.4	92.5	89.1	85.9
5.50	121.8	114.5	109.0	104.5	100.8	97.0	93.0	89.4	86.2
5.00	123.9	116.5	109.9	105.3	101.5	97.5	93.3	89.7	86.4
4.50	124.3	117.8	111.7	106.0	102.1	98.0	93.6	90.0	86.6
4.00	124.6	111.9	112.6	107.5	102.6	98.5	94.0	90.3	86.9
3.50	124.8	118.1	112.7	108.5	103.6	98.9	94.4	90.6	87.2
3.00	124.9	118.2	112.8	108.5	104.8	99.3	94.8	90.9	87.4
2.50	125.2	118.4	112.9	108.6	104.7	100.8	95.0	91.2	87.6
2.00	126.9	118.8	113.2	108.8	104.5	100.8	95.8	91.3	87.7
1.50	129.2	120.3	113.6	108.9	104.4	100.5	96.9	91.4	87.8
1.00	132.9	122.5	114.7	109.0	104.4	100.4	96.6	92.2	88.1
0.50	139.0	125.4	116.6	109.3	109.3	103.8	98.9	94.3	89.5
0.00	81.1	69.9	62.8	57.5	54.1	51.4	49.1	46.8	44.6

Y GRID COORDS	X GRID COORDINATES 16.87	17.50	18.12	18.75	19.37	20.00
16.00	43.3	41.9	40.6	39.6	39.1	19.4
15.50	82.9	80.9	79.0	77.6	76.8	38.1
15.00	82.1	80.2	78.6	77.6	76.7	38.0
14.50	81.4	79.7	78.5	77.5	76.6	37.9
14.00	80.8	79.5	78.5	77.5	76.6	37.9
13.50	80.6	79.5	78.4	77.4	76.5	38.0
13.00	80.6	79.4	78.3	77.3	76.4	38.0
12.50	80.6	79.4	78.3	77.2	76.5	38.0
12.00	80.5	79.4	78.2	77.2	76.6	38.0
11.50	80.4	79.2	78.2	77.2	76.6	38.1
11.00	80.2	79.1	78.0	77.3	76.7	38.1
10.50	80.1	79.0	77.9	77.2	76.7	38.1
10.00	80.1	78.9	77.8	77.2	76.7	38.1
9.50	80.0	78.8	77.8	77.1	76.6	38.1
9.00	80.0	78.7	77.7	77.1	76.5	38.0
8.50	80.3	78.6	77.7	77.0	76.4	37.9
8.00	80.7	78.9	77.7	76.9	76.2	37.7
7.50	81.2	79.3	77.9	76.8	75.9	37.6
7.00	81.7	79.7	78.1	76.7	75.7	37.5
6.50	82.2	80.0	78.3	76.9	75.6	37.5
6.00	82.6	80.3	78.7	77.1	75.8	37.4
5.50	83.1	80.7	79.0	77.4	76.0	37.4
5.00	83.3	81.2	79.4	77.8	76.3	37.5
4.50	83.6	81.6	79.8	78.1	76.6	37.6
4.00	83.8	81.8	80.3	78.5	76.9	37.7
3.50	84.0	82.0	80.5	78.9	77.2	37.9
3.00	84.2	82.2	80.7	79.2	77.6	38.1
2.50	84.5	82.4	80.9	79.6	78.1	38.4
2.00	84.8	82.7	81.2	79.9	78.6	38.6
1.50	85.1	83.0	81.4	80.1	79.7	39.0
1.00	85.6	84.4	82.4	80.9	79.6	39.0
0.50	86.7	84.2	82.2	80.7	79.4	38.9
0.00	43.2	42.0	41.0	40.2	39.6	19.4

ANALYSIS RESULTS

AVERAGE SHOCK PRESSURE AND SCALED SHOCK IMPULSE ON BLAST SURFACE DUE TO WAVES OFF REFLECTING SURFACES DUE TO INCIDENT WAVE

SURFACE	1	2	3	4	
IMPULSE	38.0	0.0	17.3	13.0	55.5
PRESSURE	929.3	0.0	76.4	36.9	1392.2

MAXIMUM AVERAGE SHOCK PRESSURE AND TOTAL AVERAGE SHOCK IMPULSE ON BLAST SURFACE

SCALED IMPULSE	123.8
IMPULSE	574.5
PRESSURE	1392.2

IMPULSE DURATION ON BLAST SURFACE = 0.83 MS
SCALED IMPULSES HAVE BEEN DIVIDED BY W**(1/3) = 4.64
SCALED IMPULSES ARE PSI-MS/LBS**1/3, IMPULSES ARE PSI-MS, PRESSURES ARE PSI

PROGRAM SHOCK
VERSION 1.0

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PROGRAM FOR CALCULATION OF AVERAGE BARRIER REFLECTED SHOCK PRESSURES AND IMPULSES DUE TO AN INCIDENT WAVE AND REFLECTED WAVES FROM ONE TO FOUR REFLECTION SURFACES.
ORIGINAL PROGRAM "PAIMPRES" DEVELOPED BY AMMANN AND WHITNEY
MODIFIED TO "SHOCK" BY NAVAL CIVIL ENGINEERING LAB

INPUT DATA

DATA SET TITLE:
EXAMPLE PROBLEM 2 - AREA REDUCED SURFACE, COMPRESSED GRID OUTPUT

A. CHARGE WEIGHT, LBS	100.00	
B. DISTANCE TO BLAST SURFACE, FT	5.00	
C. WIDTH OF BLAST SURFACE, FT	16.00	
D. HEIGHT OF BLAST SURFACE, FT	10.00	
E. HORIZONTAL CX) DISTANCE TO CHARGE FROM REFLECTING SURFACE NO. 2, FT	5.00	
F. VERTICAL (Y) DISTANCE TO CHARGE FROM REFLECTING SURFACE NO. 1, FT	5.00	
G. REFLECTING SURFACES "1" FOR FULL REFLECTION, "0" FOR NONE		
SURFACE 1 (FLOOR)	1	
SURFACE 2 (LEFT SIDEWALL)	1	
SURFACE 3 (CEILING)	1	
SURFACE 4 (RIGHT SIDEWALL)	1	
H. REDUCED SURFACE CALCULATION	YES	
CORNERS OF REDUCED AREA; X, Y; FT		
UPPER LEFT CORNER	4.00	12.00
UPPER RIGHT CORNER	12.00	12.00
LOWER LEFT CORNER	4.00	4.00
LOWER RIGHT CORNER	2.00	4.00

IMPULSE GRID

NUMBER OF VERTICAL GRID LINES ON BLAST SURFACE 33
NUMBER OF HORIZONTAL GRID LINES ON BLAST SURFACE 33
NUMBER OF VERTICAL LINES ON REDUCED SURFACE 17
NUMBER OF HORIZONTAL LINES ON REDUCED SURFACE 26

DISTANCE BETWEEN VERTICAL GRID LINES = 0.50 FT
DISTANCE BETWEEN HORIZONTAL GRID LINES = 0.31 FT

		SPECIFIED COORDINATE (FT)	CLOSEST GRID POINT	GRID POINT COORDINATE (FT)
AREA UPPER LEFT CORNER	X	4.00	9	4.00
	Y	12.00	39	11.87
AREA LOWER RIGHT CORNER	X	12.00	25	12.00
	Y	4.00	14	4.06

COMPRESSED IMPULSE GRID IN PSI-MS/LBS**1/3

Y GRID COORDS	X GRID COORDINATES 4.00	5.50	7.00	8.50	10.00	11.50
11.87	1172.3	1257.9	897.9	475.8	278.4	179.9
10.94	1185.8	1272.6	909.6	484.7	285.0	185.5
10.00	601.9	645.4	462.0	247.6	146.4	95.4
9.06	447.8	465.2	384.3	293.2	214.1	169.8
8.12	357.7	359.7	315.1	249.1	196.9	166.3
7.19	327.9	325.9	290.3	236.5	192.5	166.1
6.25	331.3	329.5	290.4	238.9	194.4	167.5
5.31	340.8	339.0	294.3	241.0	197.5	169.6
4.37	338.7	337.6	293.3	240.3	197.2	168.5

ANALYSIS RESULTS

AVERAGE SHOCK PRESSURE AND SCALED SHOCK IMPULSE ON REDUCED SURFACE DUE TO WAVES OFF REFLECTING SURFACES DUE TO INCIDENT WAVE

SURFACE	1	2	3	4	
IMPULSE	29.8	29.9	190.0	17.0	91.4
PRESSURE	320.3	332.2	6607.2	60.3	2779.1

MAXIMUM AVERAGE SHOCK PRES. AND TOTAL AVERAGE SHOCK IMPULSE ON REDUCED SURFACE

SCALED IMPULSE	358.1
IMPULSE	1662.1
PRESSURE	6607.2

IMPULSE DURATION ON BLAST SURFACE = 0.50 MS
SCALED IMPULSES HAVE BEEN DIVIDED BY W**(1/3) = 4.64
SCALED IMPULSES ARE PSI-MS/LBS**1/3, IMPULSES ARE PSI-MS, PRESSURES ARE PSI

PROGRAM SHOCK
VERSION 1.0

PROGRAM FOR CALCULATION OF AVERAGE BARRIER REFLECTED SHOCK PRESSURES AND IMPULSES DUE TO AN INCIDENT WAVE AND REFLECTED WAVES FROM ONE TO FOUR REFLECTION SURFACES.
ORIGINAL PROGRAM "PAIMPRES" DEVELOPED BY AMMANN AND WHITNEY
MODIFIED TO "SHOCK" BY NAVAL CIVIL ENGINEERING LAB

INPUT DATA

DATA SET TITLE:
EXAMPLE PROBLEM 3 - POINT REDUCED SURFACE, FULL GRID OUTPUT

A. CHARGE WEIGHT, LBS	100.00
B. DISTANCE TO BLAST SURFACE, FT	5.00
C. WIDTH OF BLAST SURFACE, FT	16.00
0. HEIGHT OF BLAST SURFACE, FT	16.00
E. HORIZONTAL (X) DISTANCE TO CHARGE FROM REFLECTING SURFACE NO. 2, FT	5.00
F. VERTICAL (Y) DISTANCE TO CHARGE FROM REFLECTING SURFACE NO. 1, FT	5.00
G. REFLECTING SURFACES	
"1" FOR FULL REFLECTION, "0" FOR NONE	
SURFACE 1 (FLOOR)	1
SURFACE 2 (LEFT SIDEWALL)	0
SURFACE 3 (CEILING)	0
SURFACE 4 (RIGHT SIDEWALL)	0
H. REDUCED SURFACE CALCULATION	YES
LOCATION OF POINT	
X DISTANCE FROM SURFACE 2, FT	6.00
Y DISTANCE FROM SURFACE 1, FT	10.00

IMPULSE GRID

NUMBER OF VERTICAL GRID LINES ON BLAST SURFACE 33
NUMBER OF HORIZONTAL GRID LINES ON BLAST SURFACE 33

DISTANCE BETWEEN VERTICAL GRID LINES = 0.50 FT
DISTANCE BETWEEN HORIZONTAL GRID LINES = 0.50 FT

			SPECIFIED COORDINATE (FT)	CLOSEST GRID POINT	GRID POINT COORDINATE (FT)
DISTANCE FROM SURFACE	2	(X)	6.00	13	6.00
DISTANCE FROM SURFACE	1	(Y)	10.00	21	10.00

FULL IMPULSE GRID IN PSI-MS/LBS**1/3

Y GRID COORDS	X GRID COORDINATES 6.00
10.00	102.0

ANALYSIS RESULTS

AVERAGE SHOCK PRESSURE AND SCALED SHOCK IMPULSE ON REDUCED SURFACE DUE TO WAVES OFF REFLECTING SURFACES DUE TO INCIDENT WAVE

SURFACE	1	2	3	4	
IMPULSE	25.6	0.0	0.0	0.0	76.4
PRESSURE	179.6	0.0	0.0	0.0	2975.8

MAXIMUN AVERAGE SHOCK PRES. AND TOTAL AVERAGE SHOCK IMPULSE ON REDUCED SURFACE

SCALED IMPULSE	102.0
IMPULSE	473.7
PRESSURE	2975.8

IMPULSE DURATION ON BLAST SURFACE = 0.32 MS
SCALED IMPULSES HAVE BEEN DIVIDED BY W**(1/3) = 4.64
SCALED IMPULSES ARE PSI-MS/LBS**1/3, IMPULSES ARE PSI-MS, PRESSURES ARE PSI